

An Implementation on Project Management in the Construction Sector

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ABSTRACT

In the increasingly globalized world, the most important goal of the businesses is trying to do activities both in time and with the least cost by managing the resources productively. The businesses attach the importance to planning, programming and controlling for the purpose of increasing productivity and ensuring coordination on the ground of increasing competition and extensity of the works. Because of that reason, today Project and Project management become unavoidable in each sector. Regardless of the work done with Project management, activities are seen as whole, these activities are examined thoroughly with the appropriate methods of Project analysis and it is created a business plan. The business plans differ in not only management strategies of the business but also application methods in sectors.

In this study, it is aimed to examine the contribution of the time analysis to the Project by using the Project planning techniques in a constructional Project. In accordance with this purpose, the Project of the main warehouse conducted in Pamukkale University is investigated with the Project methods and techniques and it is estimated how long it will take. It is put forward reasons for differences by comparing the results with data obtained from the analysis and the actual time of Project.

Keywords: *Project Management, Project Time Analysis, Project Management in Construction Sector, Critical Path Method (CPM)*

INTRODUCTION

In the circumstances of increasing competition and the great prominence of the time in today's globalized world, the most important goal of businesses is to manage the resources efficiently and effectively. For this reason, it is attempted to accomplish activities in minimum time and at minimum cost. Developing technology pushes businesses to be different from their rivals by adapting themselves to innovations. From past to present, people, in order to achieve their goals, have always conducted their activities within a plan and in this way they have been successful.

Project management, an essential management system in applications in almost every field, minimizes the uncertainties in businesses and examines to the last detail of all the activities that make up the project.

Though nowadays, its tools and techniques have been widely used, project management extends its roots to the Egyptian period. In 1950s, navy forces had used modern project management methodologies. In 60s and 70s, military forces, NASA and the engineering departments of major construction companies had used project management principles and tools to manage budget and time. In 1980s, applications in the manufacturing and software industries were adopted and large-scale management practices to implement project had begun. By the 1990s, project management, its tools and techniques applications were seen in many different industries [1]. The first scientific studies about project management was carried out by Frederick Taylor in the beginning of the 1990s. Gantt Charts, developed by Henry L. Gantt, form the basis for PERT (Program Evaluation and Review Techniques), today's one of the commonly used methods of project monitoring and evaluation, besides gave impetus to project management practices [2].

By making progress, applications in the construction sector have reached great heights. In addition to the performance of the projects (bridges, dams, roads, etc.), they have begun to be evaluated in terms of time and cost. Accordingly, stages and techniques of project management in the construction sector have gained importance. While Gantt Charts, implemented since the 1990s, is indispensable for the sector and implemented in all small and medium-scale projects even today, CPM and PERT are applied in larger and more complex projects.

In this study, with the intend of explaining the importance of time analysis and demonstrating the position of CPM, one of the techniques of project management, in application in a structural design, it has been calculated that in how much time the project will be completed and by comparing it with the actual time of the project, the reasons for the difference are outlined.

PROJECT MANAGEMENT OVERVIEW

In this section of the study, the phases of project management and techniques are examined explaining the project and the concepts of the project management. The determination of the completion period of the specific project and the identification of activities time and the relationship between them are important issue. Therefore the analysis of time is examined in detail under a head.

The Concepts and Phases of Project Management

Project is a route map through which can be reached optimum results to achieve predetermined goal by using the funds efficiently in a certain period of time. The characteristics of these project are such as: the intention to achieve a particular goal using the funds efficiently, having distinctive characteristics and specific dates to start and to finish and actualization in an organizational structure [3].

Project management is planning programming, executive and inspection studies of the common activities for the used physical and material funds for the purpose of achieving specific goal. As long as the process of the project management is coordinated successfully, the waste of funds, time loss and cost raise will be prevented [4].

The phases of project management consist of three main phases; the planning, programming(schedule) and controlling of the activities. While the process of planning and programming serve as basis of the work, the inspection part gives direction to this process.

The planning phase is the first phase which is must in the project used planning techniques for the project management which give prioty to the identification of the project and determination of the goals [5]. In this phase, the planning studies must be done which identify what, why, how and when will be done and which heps to conduct affairs and workers in the project. The preperation of appropriate time sheet for the duty and responsibility and creating a project budget are most important studies for the formation of the project planning [6].

The programming phase is calculation of the fund needs and estimated time through taking into account of the relationships of the activities. The relationship between activities, the start and end time, analysis of more important works are done with the help of project management techniques

The control phase is a phase that is existing in the each step of the project. It facilitates the evaluation of the works whether they are done completely or not and if there is, the intervention to the problems. In the controlling phase, in case of detention the critic activities which have effect upon the end time of the project.

The Techniques of Project Management

A simple definition of project management includes a handful of key premises. There is a certain beginning and end of project management. Various kind of tools are used to assess the success of the project management and to examine the project duty. These are Work Breakdown Structures, Gant charts and PERT charts [7]. Planning, programming and control activities which consist of project phases actualize more efficiently by means of the project management techniques.

Gantt schema is both a tool for the planning of simple projects and a schema including the relationships between activities in the project.

The Gant Chart failed to provide desired function due to inefficiencies such as not being able to demonstrate critical point, not being able to identify the relationships between stages and increase in project item [8]. Methods of CPM(critical part Method) and PERT (Program evaluation and review technique) from the the network analysis has been developed on behalf of showing these inefficiencies.

CPM and PERT are methods which are based on basis of the determination of the shortest time the project can be completed and are used in the planning of time and cost estimate of the whole project [9]. CPM and PERT diagrams are planned road map that indicate when the project will end. They allow to identify and solve all possible problems. They reveal the planned and actual results of each activity by showing critical and non-critical activity [8].

The business network that holds in early-late start date and early-late finish date of each activity enables us to see at a glance all elements of the project relationships, together with the time information in the same context as a whole [9]. Although CPM and pert techniques are based on the same basis as the goal by using critical path method, they also vary in determining the duration of activity. While CPM is a deterministic method that assumes the duration of activities is known with certainty, PERT determines the duration of activities by using some of the probability values.

After the duration is done for each activity by determining the precedence relationship between activities, a network diagram is drawn and early-late onset and delay time of each activity are found [6].

Time Analysis in Project Management

Project managers often talk of a triple constraint-project scope, time and cost-in managing competing project requirements. Project quality is affected by balancing these three factors. High quality projects deliver the required product, service or result within scope, on time and within budget [10].

The completion time of a specific project is primarily required to be determined and according to this time a work program is required to establish. Time analysis should be treated with detail during the planning phase for the completion of the project at the desired quality and within the optimum cost.

There is a need for effective employee time management system to use people, equipment, tools and money most efficiently in the project. The optimization of these factors is required for effective time management [11].

The deterministic methods are used such as Gantt charts, CPM, pert when doing time analysis. Project managers might know estimated completion time of the project, which activities are critical or have more importance to be completed on time. They might know which activities how long can be delayed without any delay of the completion time of the project.

PROJECT MANAGEMENT IN THE CONSTRUCTION INDUSTRY

The realization of management function activities is called construction project management for the purpose of solving problems in construction projects, the attainment of the project objectives, increase efficiency, establishing a systematic work environment between the site of the project with the top management. Construction project management must make prediction for future events and performance for the solution of the dynamic problem which is faced [12].

Applications of construction industry is becoming more large-scale and complex structure with each passing day. In conditions of increasing competition in the sector, it is compulsory that projects are evaluated not only in terms of performance but also in terms of time and cost. A firm must have all the construction process of management, planning, implementation and control in order to compete in the market [13].

Construction projects are the most complex and comprehensive examples in terms of the applicability of the project management methodology. If each phase is not designed and monitored in necessary details, is not included in measurement and evaluation, The result will be a failure in terms of monetary, quantitative and temporal perspective. Project management success is out of the question in the projects that are not completed on time and within budget [14]. So, Time analysis in project management has reached an important point and CPM next to the Gantt chart from project management techniques has begun to be used.

Features of construction project management;

- The appointment of a project manager who perform the feasibility studies and has the detailed basic information in the name of optimizing the flow of design and construction
- The assignment of an experienced management team oriented to the expectations of the project.
- The implementation of Value-engineering processes and analysis methods.
- Reducing construction time and cost by optimising the flow of organisation during design and implementation and at the same time the assurance of quality. □ Continuous checking of the interface with project goals,
- Pre-paying the bulk of the construction before the beginning of the construction phase, with construction work cost + profit is guaranteed by the agreement. (Eker, 68)

When managing a construction project Construction, there are other considerations that should be considered during the use of construction resources in the most effective way and besides achievement and implementation at least cost. Some of them are technical issues; for example, the design and selection of moulds. The other matters are complementary and they are related to the motivation of the workers, labor relations, contract forms, legal responsibilities, and job security [15].

IMPLEMENTATION

The purpose of this study is to calculate in a construction project how duration of the project will be completed by using project planning techniques and to find the reasons for the difference by comparing this time with the actual time of the project. For this purpose, the activities of main warehouse building construction work in Pamukkale University are listed according to the plan, times and start dates as below.

Table 1 Main storage of the building construction activities and durations

ACTIVITIES		START DATE	PERIOD (WEEK)
EXCAVATION AND FILLING WORKS	A	MARCH 4th WEEK	2
CONCRETE WORKS	D	APRIL 1st WEEK	12
WALL WORKS	N	MAY 3rd WEEK	9
INSULATION AND DRAINAGE WORKS	B	MARCH 4th WEEK	5
FORM AND SCAFFOLDING WORKS	E	APRIL 1st WEEK	12
IRON WORKS	G	APRIL 1st WEEK	16
FRAMEWORKS	Q	JUNE 1st WEEK	9
WOOD AND GLAZING WORKS	V	JULY 4th WEEK	3
PLASTER WORKS	P	MAY 4th WEEK	9
PAINTWORKS	T	JULY 1st WEEK	7
FLOOR AND WALL COVERINGS	S	JUNE 3rd WEEK	8
TRUCKAGES	C	MARCH 4th WEEK	13
VITRIFIED EQUIPMENT AND FITTINGS	W	JULY 4th WEEK	3
SINK SHOWER TRAY AND FITTINGS	X	JULY 4th WEEK	3
DRINKING FOUNTAIN WORKS	Y	JULY 4th WEEK	3

FIRE CABINET WITH TUBE	Z	JULY 4th WEEK	3
COLD COUNTER, ELECTRIC WATER HEATER	Activitiy27	JULY 4th WEEK	3
WELDED GALVANIZED PIPE FITTING MATERIAL COST	U	JULY 3rd WEEK	2
PVC PLASTIC DRAIN PIPE	I	MAY 1st WEEK	4
SOFT POLY.PRESSURE PIPE AND MON.MAT.PRICE	J	MAY 1st WEEK	4
BALL VALVE (PN SCREW, 10-16)	K	MAY 1st WEEK	4
PAINTED PIPE, IRON WORKS	L	MAY 1st WEEK	4
WIRES	F	APRIL 1st WEEK	4
DASHBOARDS AND SALT INGREDIENTS	H	APRIL 3rd WEEK	3
LINE AND ILLUMINATION FIXTURES	Activitiy28	AUGUST 1st WEEK	2
GALVANIZED CHANNELS	R	JUNE 2nd WEEK	4
LOW-VOLTAGE WIRING	M	MAY 1st WEEK	4
1600 KG HYDRAULIC FREIGHT ELEVATOR	O	MAY 3rd WEEK	8

Protocol and precedence relationships between activities are identified as related in Table 2 and accordingly a work programme has been prepared.

Table 2 Activities Relations

ACTIVITIES	PREVIOUS ACTIVITIES
A	-
B	-
C	-
D	-
E	-
F	-
G	-
H	A
I	A,B,F
J	A,B,F
K	A,B,F
L	A,B,F
M	A,B,F
N	A,B,F,H
O	A,B,F,H
P	A,B,F,H

Q	A,B,F,H,I,J,K,L,M
R	A,B,F,H,I,J,K,L,M
S	A,B,F,H,I,J,K,L,M
T	A,B,F,H,I,J,K,L,M
U	A,B,C,D,E,F,H,I,J,K,L,M,O
V	A,B,C,D,E,F,H,I,J,K,L,M,N,O,R
W	A,B,C,D,E,F,H,I,J,K,L,M,N,O,R
X	A,B,C,D,E,F,H,I,J,K,L,M,N,O,R
Y	A,B,C,D,E,F,H,I,J,K,L,M,N,O,R
Z	A,B,C,D,E,F,H,I,J,K,L,M,N,O,R
Activity27	A,B,C,D,E,F,H,I,J,K,L,M,N,O,R
Activity28	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,R,U

The critical path consists of activities that give the shortest possible time to the completion of the project. Any delay that may occur on the network causes in a long time than the calculated completion time of the project completion due to the lack of the abundance of these activities and to be critical of all activities on the critical path. So, Critical activities should be identified and programming must be made accordingly.

Demonstration of the item, priority relations, Gantt and CPM (network diagrams are created utilizing WinQSB program; The presence of critical activities and critical path trajectories is provided. According to Critical path method(CPM) the critical activities have been identified being calculated that the analyzed project will be completed in 18 days.



Figure 1 Critical Path and Critical Activities

It was learned that the project actually completed in 20 weeks that have been applied. 2 weeks difference was found to be caused by a delay of 1 week in the activities of Q(Frameworks) located on the critical path and Activity 28 (Lighting). The cause of the delay in framework revealed due to the failure in timely completion in painted pipe and iron works before it and lighting work was determined due to the delay results from a subcontractor.

CONCLUSIONS

As project management is a management system that examines all activities makes up the project to the finest details and minimizes the uncertainties in the projects which is conducted by business, it has become indispensable for all sectors from past to present. Project management techniques are used in the construction industry in order to be used the construction resources in the most optimal way and beside to achieve at least cost.

As CPM from the project techniques shows critical activities, includes extension period of the project but it will not affect expiration of the project period in other activities, deploys time analysis and dependently it enables for the optimal determination of the cost, the usage of this method will reveal more effective results even though the scope of construction project is narrow.

Critical activities have been determined and that the project analyzed will be completed in 18 weeks according to CPM. It was learned that the project actually conducted was completed in 20 weeks and it is stated that the critical activities are due to this delay. The appropriate controls accordingly could be foreseen by predetermining critical activities in the project analyzed using this method.

As the project analyzed is in the scope of the university, the cost calculations could not be obtained. However, in the conditions of increasing competition, a 2 week delay in construction sector will cause both business to miss the opportunities and project to be completed with more cost and time. Therefore critical activities should be determined in the project used CPM method and accordingly control measure should be taken.

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